临床研究

不同血运重建方式治疗复杂冠状动脉病变合并左心功能不全的围术期疗效比较

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摘要:目的　对比研究冠状动脉旁路移植术(CABG)和经皮冠状动脉介入术(PCI)治疗复杂冠状动脉病变合并左心功能不全(LVD)的围术期疗效。**方法**　回顾性分析2003年1月~2013年12月在我院接受CABG和PCI治疗的复杂冠脉病变合并左心功能不全(左室射血分数LVEF≤50%)患者的临床资料,其中CABG患者386例,PCI患者580例,采用1∶1配对方法,以EuroSCORE危险因素及术前超声心动图指标为配对标准,两组各纳入患者135例,比较两组患者近期结果及术前术后左室形态及功能变化。**结果**　两组患者基线资料比较,PCI组慢性肺病及3个月内心梗发生率显著高于CABG组(8.1% *vs* 0.7%,*P*=0.003;64.4% *vs* 31.9%,*P*=0.000),而左主干病变比例显著低于CABG组(12.6% *vs* 23.7%,*P*=0.018),其它方面两组之间无统计学差异。血运重建结果比较:CABG组处理的靶血管数目明显多于PCI组(2.90±0.81 *vs* 1.67±0.73,*P*=0.000),完全再血管化程度明显高于PCI组(94.8% *vs* 51.8%,*P*=0.000)。术后术前超声结果比较:CABG组与PCI组LVEF差值无显著差异(*P*=0.171),而CABG组LVEDD差值明显高于PCI组(*P*=0.000)。围术期不良事件方面,两组住院死亡率及其它严重并发症无统计学差异。**结论**　对于复杂冠脉病变合并LVD患者,CABG与PCI均为安全可行的血运重建方式。与PCI相比,CABG完全再血管化程度更高,术后早期左心功能改善更为明显。

关键词:血运重建;冠状动脉旁路移植术;经皮冠状动脉介入术;左心功能不全

Different approaches to revascularization for complex coronary artery disease and left ventricular dysfunction: analysis of perioperative outcomes

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Abstract: Objective To compare the perioperative outcomes of coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) for treatment of complex coronary artery disease and left ventricular dysfunction. **Methods** The clinical data of 966 patients admitted to our hospital from January 2003 to December 2013 with coronary artery disease and left ventricular dysfunction (ejection fraction ≤50%) were retrospectively reviewed. Among the patients, 386 underwent CABG and 580 received PCI. After matching for EuroSCORE risk factors and preoperative echocardiographic parameters, 135 patients with CABG and 135 with PCI were enrolled in this study. With hospital mortality and perioperative major complications as the endpoints, the early outcomes of the procedures were evaluated. Perioperative echocardiography was performed to evaluate the change of left ventricular geometry and function. **Results** Compared with CABG group, PCI group had significantly higher incidences of chronic lung disease (8.1% *vs* 0.7%, *P*=0.003) and recent myocardial infarction (64.4% vs 31.9%, *P*=0.000) but significantly lower left-main disease (12.6% *vs* 23.7%, *P*=0.018); the other baseline characteristics were comparable between the two groups. Patients with CABG had a greater number of treated target vessels than those with PCI (2.90±0.81 *vs* 1.67±0.73, *P*=0.000), and complete revascularization was more common in CABG group (94.8% *vs* 51.8%, *P*=0.000). No significant difference was found in perioperative variations of LVEF between the two groups, but patients with CABG had a greater variation in LVEDD than those with PCI. The hospital mortality and other major complications were similar between the two groups. **Conclusion** Both CABG and PCI are safe and reliable revascularization strategies for complex coronary artery disease and left ventricular dysfunction, but CABG can achieve a higher rate of complete revascularization and better improves the left ventricular function.

Key words: myocardial revascularization; coronary artery bypass grafting; percutaneous coronary intervention; left ventricular dysfunction

冠状动脉旁路移植术(CABG)与经皮冠状动脉介入术(PCI)是目前治疗缺血性心脏病(IHD)最主要的血运重建方式。近年来,大量前瞻性随机对照研究(RCT)已证明对于简单冠脉病变PCI与CABG疗效相

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近[1-3]，对复杂冠脉病变如左主干病变或累及前降支的三支病变，PCI与CABG在SYNTAX低分值患者中疗效相近，而中分值及高分值患者更能从CABG中获益[4-8]，以上研究结果直接促进了相关指南在治疗推荐上的改变[9]。但是，以上研究均存在将左心功能不全患者排除在外或纳入比例过低的问题，因此，基于此类研究基础上制定的血运重建指南不能完全适用于复杂冠脉病变合并LVD患者的临床治疗。目前尚无直接比较PCI与CABG的RCT研究，几项大型的回顾性研究也主要集中于比较两种治疗方式的长期结果[10]。基于此，本研究拟对比分析不同血运重建方式治疗复杂冠脉病变合并LVD的围术期结果，为该类患者寻找最佳的血运重建策略提供临床证据。

1 资料和方法

1.1 对象与分组

2003年1月~2013年12月，13852例缺血性心脏病患者在我院接受单纯血运重建治疗，其中PCI组11576例，CABG组2276例。按照以下入排标准选择研究对象共966例，其中PCI组586例，CABG组380例。入选标准：(1)诊断冠状动脉粥样硬化性心脏病，稳定或不稳定心绞痛；(2)术前冠状动脉造影证实为左主干病变或累及前降支近端的3支血管病变；(3)术前超声心动图证实LVEF≤50%，伴或不伴心功能不全的症状、体征。排除标准：(1)急诊行PCI或CABG的患者；(2)合并其它心内疾病需要同期手术(如二尖瓣或主动脉瓣置换或左心室室壁瘤切除等)。先以术前超声心动图参数(LVEF，LVEDD)为主要配对指标，初步筛选出PCI组与CABG组相配对患者(数值上下波动≤2)，再以EuroSCORE危险因素(高血压病、高脂血症、糖尿病、年龄、性别等)为次要配对指标，在PCI组筛选出与CABG组基本匹配的患者，按1∶1的比率最终选取135对患者纳入研究。

1.2 处理方法

PCI组患者术中由心脏介入医生根据造影结果及患者病情给予球囊扩张或支架植入(药物洗脱支架，drug eluting stent，DES或裸金属支架，bale metal stent，BMS)。CABG组患者术中根据患者病情和术者习惯采用非体外循环CABG或心肺转流下CABG，左乳内动脉常规与前降支吻合，其余采用大隐静脉进行吻合。全部患者均在术前及术后1周内行超声心动图检查。

1.3 观察指标

收集患者围术期资料及术前术后超声心动图检查结果，以手术死亡及严重并发症等不良事件为终点事件比较两组近期临床结果，以术前术后左室射血分数(LVEF)及左室舒张末期内径(LVEDD)的差值比较来评价左心室形态及功能变化。

1.4 统计学处理

采用SPSS15.0统计学软件，对所有数据进行正态性和方差齐性检验，正态分布的计量资料用均数±标准差表示，两组间基线资料及围术期不良事件比较采用独立样本*t*检验，手术前后差值比较采用配对样本*t*检验；非正态分布的计量资料采用M(QR)表示，组间比较采用非参数检验。计数资料用率和百分比表示，组间比较用χ^2检验，$P<0.05$认为差异有统计学意义。

2 结果

两组患者基线资料比较见表1。PCI组患者在慢性肺病史及3个月内心梗病史发生率方面显著高于CABG组(8.1% *vs* 0.7%，P=0.003；64.4% *vs* 31.9%，P=0.000)，但左主干病变发生率显著低于CABG组(12.6% *vs* 23.7%，P=0.018)。

两组患者血运重建结果见表2。CABG组处理的靶血管数目明显多于PCI组(2.90±0.81 *vs* 1.67±0.73，P=0.000)，并且CABG组患者的完全再血管化程度也显著高于PCI组(94.8% *vs* 51.8%，P=0.000)。

两组患者围术期超声心动图检查结果(表3~4)。组内比较，两组患者术后LVEF较术前均有显著改善(P=0.000)，CABG组术后LVEDD较术前明显缩小(P=0.000)，而PCI组术后LVEDD较术前无明显改变(P=0.361)。组间比较，PCI组与CABG组患者术前术后LVEF差值无显著差异(P>0.05，P=0.171)，而CABG组术前术后LVEDD的差值显著高于PCI组(P=0.000)。

两组患者围术期不良事件比较见表5。两组患者在手术死亡、严重室性心律失常、术后肾衰、低心排、呼吸功能不全、围术期使用IABP及脑血管并发症等方面差异均无统计学意义(P>0.05)。

3 讨论

本研究结果显示，对于复杂冠脉病变合并LVD患者，CABG与PCI均为安全可行的血运重建方式。与PCI相比，CABG完全再血管化程度高，术后早期左心功能改善更为明显。

多项研究显示接受CABG或PCI治疗的IHD患者中合并LVD的比例总体偏低。CREDO-Kyoto研究中，26个中心3年时间共纳入15939例患者，其中左主干或三支病变同时LVEF低于50%的患者为908例，占比为5.70%[10]。国内阜外医院一组接受CABG治疗的IHD合并LVD(LVEF≤40%)的患者7年共计239例[11]，另一组接受PCI治疗的IHD合并LVD患者(LVEF≤40%)7年共计191例，占同期PCI治疗患者总数的4.41%(191/4335)[12]。本研究入选对象均为左主干或3支病变合并

表1 CABG组及PCI组患者的术前资料比较

Tab.1 Preoperative baseline Characteristics in CABG and PCI groups

	CABG(*n*=135)	PCI(*n*=135)	*P*
Gender (Males/Females)	109/26	105/30	0.550
Age (*Mean*±*SD*, year)	62.23±10.14	62.21±12.27	0.987
Weight (*Mean*±*SD*, kg)	70.17±10.24	71.55±12.81	0.329
Complications or comcerbidities [*n*(%)]			
Hypertension	87(63.0)	88(65.2)	0.899
Hypercholesterolemia	26(19.2)	30(22.2)	0.550
Diabetes mellitus	46(34.1)	53(39.2)	0.379
Renal disease	42(31.1)	29(21.5)	0.234
COPD[a]	1(0.7)	11(8.1)	0.003
Cerebrovascular disease	2(1.5)	4(3.0)	0.411
Peripheral vascular disease	11(8.1)	21(15.5)	0.060
Critical preoperative state[b]	7(5.2)	12(8.9)	0.236
Recent MI in 3 months	43(31.9)	87(64.4)	0.000
Angiographic profile			
Multivessel coronary	127(94.1)	126(93.6)	0.803
Artery disease *n*(%)			
Left main stenosis *n*(%)	32(23.7)	17(12.6)	0.018
Pre-operative heart functional variables			
LVEF(*Mean*±*SD*, %)	42.53±5.73	42.50±5.78	0.985
LVEDD(*Mean*±*SD*, mm)	52.41±6.20	52.29±6.74	0.873

[a]Chronic obstructive pulmonary disease; [b] including ventricular tachycardia, ventricular fibrillation, in need of CPR, Intra-aortic balloon pump or vasoactive agents support, acute renal failure.

表2 两组患者血运重建治疗结果

Tab.2 Results of myocardial revascularization in CABG and PCI groups

	CABG(*n*=135)	PCI(*n*=135)	*P*
Treated lesion/patient (*Mean*±*SD*)	2.90±0.81	1.67±0.73	0.000
Total revascularization(*n*, %)	128(94.8)	70(51.8)	0.000
Internal mammary artery(%)	99.26		
Drug-eluting stent(%)		97.7	

LVD患者，占同期接受血运重建治疗患者的6.97%，高于以上研究报道。

随着血运重建技术的进步，CABG与PCI的治疗安全性不断提高。大组研究结果显示，择期CABG住院死亡率及各项严重并发症(中风、低心排、呼吸功能不全、肾功能不全等)的发生率均在1%~2%[13-14]。而择期PCI的住院死亡率在0.65%~1%[15]，严重并发症如中风、纵隔出血、急诊CABG均在0.5%以内[16]。本研究中CABG与PCI两组患者住院死亡率、中风、纵隔出血等并发症

表3 两组患者血运重建前后超声心动图结果比较

Tab.3 Echocardiographic results of pre- and post-myocardial revascularization in PCI and CABP

Variables	LVEF(*Mean*±*SD*, %)			LVEDD(*Mean*±*SD*, mm)		
	Pre-op	Post-op	*P*	Pre-op	Post-op	*P*
PCI	42.50±5.78	47.98±9.35	0.000	52.29±6.74	51.52±7.08	0.361
CABG	42.53±5.73	46.68±7.81	0.000	52.41±6.20	48.10±6.46	0.000

与文献报道接近，而低心排、肾功能不全及呼吸功能不全并发症高于文献报道，与本组患者均为复杂冠脉病变且合并LVD有直接联系。

完全再血管化是血运重建治疗的最高目标，已有大量研究证明完全再血管化对于缓解心绞痛、改善心功能并提高远期生存率均明显优于不完全再血管化[17-18]。Ong等将完全再血管化的定义分为解剖型、功能型或生理型等5种，临床工作及研究中最为常用的是解剖型[19]。与CABG相比，PCI治疗复杂冠脉病变完全再血管化率低，主要原因是该类患者中慢性完全闭塞性血管病变

表4 两组患者血运重建前后超声心动图差值比较

Tab.4 Echocardiography D-value results of pre-and post-operative myocardial revascularization in PCI and CABG groups

Variables	LVEF(*Mean*±*SD*, %)		LVEDD(*Mean*±*SD*, mm)	
	PCI	CABG	PCI	CABG
Pre-op	42.50±5.78	42.53±5.73	52.29±6.74	52.41±6.20
Post-op	47.98±9.35	46.68±7.81	51.52±7.08	48.10±6.46
D-value	5.43±8.76	4.14±6.41	-0.77±6.16	-4.31±5.36

表5 两组患者围术期不良事件的比较

Tab.5 Perioperative adverse events in CABG and PCI groups (*n*, %)

Perioperative adverse events	CABG (*n*=135)	PCI (*n*=135)	*P*
Cardiac death	1 (0.7)	0 (0)	0.318
Respiratory failure	4 (3.0)	1 (0.7)	0.177
Ventricular arrhythmia	4 (3.0)	2 (1.5)	0.411
Postoperative renal failure	6 (4.4)	3 (2.2)	0.311
Low output syndrome	5 (3.7)	5 (3.7)	1.000
Cerebrovascular complications	1 (0.7)	0 (0)	0.318
Intra-aortic balloon pump	7 (5.2)	5 (3.7)	0.556
Pericardial tamponade	2 (1.5)		
Deep wound infection	0 (0)		
Emergent CABG		0 (0)	

(Chronic total occlusions, CTO)和分叉病变比例较高，此外PCI治疗对靶血管最小直径的要求高于CABG (2 mm *vs* 1.5 mm)，而这些情况是影响PCI完全血运重建的主要因素[20]。对SYNTAX研究的4年结果分析显示，存在CTO病变是导致PCI不完全再血管化的独立影响因素，PCI组不完全再血管化率达到46.6%[21]。而一项涉及89 000余例患者的Meta分析结果显示，接受CABG治疗的完全再血管化比例显著高于PCI治疗[22]。本研究采用“解剖型”定义完全再血管化，结果与以上研究一致，CABG组完全再血管化率显著高于PCI组(94.8% *vs* 51.8%，P=0.000)。

完全与不完全再血管化对左心功能的改善情况也已得到多项研究的证实。Sharon等[23]的研究显示，对多支病变合并LVD的患者，完全血运重建能够有效提高LVEF，而不完全血运重建或血运重建失败LVEF无变化。Kirschbaum等[24]发现PCI开通CTO病变可有效减小左室收缩末及舒张末容积，提示完全再血管化可明显改善左室形态与功能。我们的研究也发现，CABG组术后左室舒张末内径缩小程度显著高于PCI组。尽管CABG组LVEF的改善程度与PCI组无显著差异，但由于CABG患者术后早期心功能受到术中麻醉、心脏停跳、体外循环等多种因素的负面影响，其完全再血管化带来的获益会被以上负面因素引起的短暂性心肌顿抑所抵消，左室收缩功能的改善会在后期逐步体现。

本研究是回顾性研究，存在其固有的选择偏倚等非随机对照试验的缺陷，另外样本量偏小也可能对最终结果产生影响。但本研究采用1:1配对的方式对两组之间基线资料进行了相应调整，组间差异小，统计学效力相对较强。积极开展多中心前瞻性随机对照临床试验仍是解决这一研究领域相关问题的努力方向。

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